

SPHN/PHRT – MedCo in Action: Empowering the Swiss Molecular Tumor Board with Privacy-Preserving and Real- Time Patient Discovery

Jean Louis RAISARO^{a,1}, Juan Ramòn TRONCOSO-PASTORIZA^b, Sylvain PRADERVAND^a, Michel CUENDET^a, Mickael MISBACH^b, Joao SA^b, Francesco MARINO^b, Nicolas FREUNDLER^a, Nicolas ROSAT^a, David CAVIN^c, Alexander LEICHTLE^d, Jacques FELLAY^{a,b}, Olivier MICHIELIN^a and Jean-Pierre HUBAUX^b
^a Lausanne University Hospital; ^b EPFL ; ^c Geneva University Hospital; ^d Bern University Hospital

Abstract. MedCo is the first operational system that makes sensitive medical-data available for research in a simple, privacy-conscious and secure way. It enables a consortium of clinical sites to collectively protect their data and to securely share them with investigators, without single points of failure. In this short paper, we report on our ongoing effort for the operational deployment of MedCo within the context of the Swiss Personalized Health Network (SPHN) for the Swiss Molecular Tumor Board.

Keywords. SPHN, personalized health, privacy, security, oncology, data sharing.

1. Introduction

Although within Swiss Personalized Health Network much effort is currently being put into data interoperability and integration, data privacy and security represent important challenges that, if overlooked, can potentially hinder or even block the access and use of this data across the different hospitals. To tackle these issues, researchers from the Swiss Personalized Oncology project and the Data Protection for Personalized Health (DPPH <https://dpph.ch>) project have joined forces. The intention is to work together towards the development and the adoption of cutting-edge privacy-preserving solutions for data analytics that provide strong and long-lasting protection guarantees for patient data.

2. The Swiss Molecular Tumor Board Use Case

As a first step in this direction, the idea is to empower the Swiss Molecular Tumor Board (SMTB), which is meant to be a reference for the entire country for analysing complex cases and identifying the best personalized treatment, with MedCo, the first privacy-

¹ Jean Louis Raisaro, Lausanne University Hospital (CHUV), Chemin des Roches 1, 1010 Lausanne, Switzerland ; E-mail: jean.raisaro@chuv.ch.

preserving tool issued by the DPPH project that is co-developed by EPFL and the Lausanne University Hospital (<https://medco.epfl.ch>). MedCo [1] is a data discovery system that enables a researcher or clinician to securely perform, through a user-friendly graphical interface, exploratory queries (SQL-like queries for simple statistics) on encrypted clinical and molecular data that are horizontally partitioned across different hospitals. By relying on state-of-the-art technologies for information security such as homomorphic encryption, secure multi-party computation and differential privacy, MedCo ensures (1) that patients' individual-level data are protected against illegitimate access by unauthorized people, (2) that no single authority has to be trusted for the security of the data and (3) that the re-identification risk is minimized.

Our goal is to deploy MedCo at all the University Hospitals in order to enable the SMTB to make more informed treatment decisions (Figure 1). MedCo will offer experts of the SMTB the possibility of obtaining, in real time, simple statistics and aggregate information about treatment and outcome for patients with a similar clinical and molecular profile to the ones under evaluation (e.g. overall survival, overall response rate, progression-free survival). At the same time, the use of MedCo will ensure that the privacy of both the patients in the hospitals and the patient presented at the SMTB is preserved. To securely identify similar patients, MedCo will perform an encrypted search over all the oncology patients whose data is stored encrypted in the MedCo databases that are distributed across the five Swiss University Hospitals and then compute the requested aggregate information directly on the encrypted data of the identified patients.

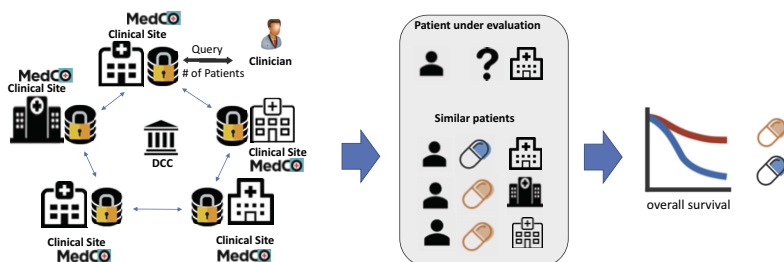


Figure 1. Envisioned use of MedCo in the Swiss Molecular Tumor Board. DCC: Data Coordination Center

3. Conclusion

MedCo will be initially deployed in the University Hospitals of Bern, Geneva and Lausanne for testing purposes. Once the data loading process, the governance and the functionalities of MedCo will be validated by the SPHN Data Coordination Center, the deployment will be extended to the University Hospitals of Basel and Zurich and the other hospitals members of the *Swiss Group for Clinical Cancer Research*, eventually.

References

- [1] J.L. Raisaro, J.R. Troncoso-Pastoriza, M. Misbach, J.S. Sousa, S. Pradervand, E. Missiaglia, O. Michielin, B. Ford, and J.P. Hubaux, MedCo: Enabling Secure and Privacy-Preserving Exploration of Distributed Clinical and Genomic Data, *IEEE/ACM transactions on computational biology and bioinformatics* **16** (2018), 1328-1341.